abridged method is very close. In a comparison recently made, covering 53 days on which observations by both methods were available, it was found that on 32 days the result by the new and the old methods agreed within less than 1%, and on 45 days within less than 2%. It was found, also, that on the days in which the agreement was not good, some change in transparency appeared to be occurring which would reasonably account for the discrepancy on the ground that the value by the old method had been impaired thereby.

The new method is applicable on many more days than the old, and it has the further advantage that several independent observations of the solar constant of radiation may be made by the new method on a single day of observation. We believe that by checking the new method against the old from time to time it will be possible to assure ourselves of the accuracy of it, and we propose to employ it principally, hereafter, in our determinations of the solar constant of radiation.

THE BASAL METABOLISM OF BOYS FROM 1 TO 13 YEARS OF AGE

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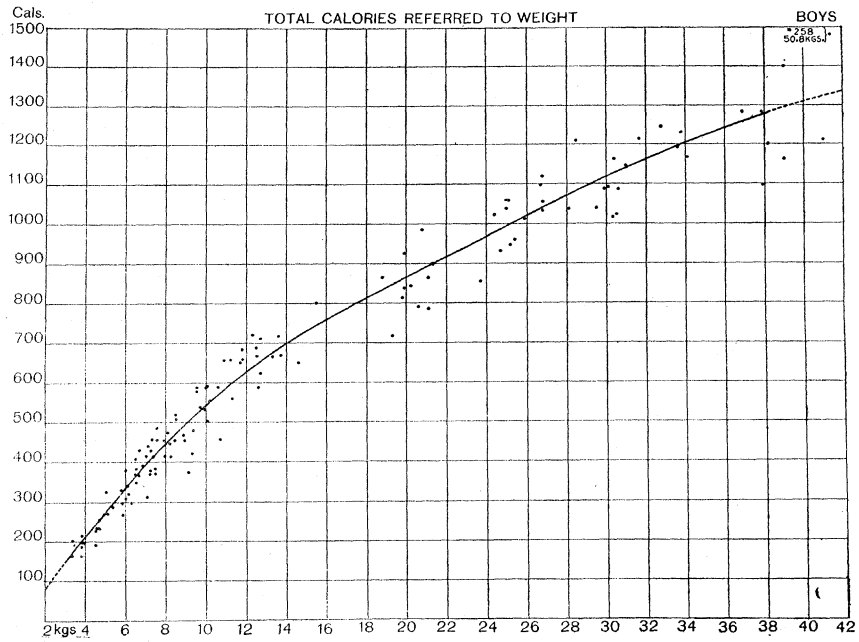
The Nutrition Laboratory has been occupied for a decade in an effort to chart the field of the basal metabolism of humans of both sexes and of all ages. By basal metabolism is meant the heat production for maintenance during complete muscular repose and without active digestion. From a biometric analysis[1] of the studies already made of men and women, it is clear that weight, stature, age, and sex all have an independent influence upon the basal metabolism.

With growing boys the rapid changes in weight, stature, and age make metabolism measurements of unusual interest. The data that are reported herewith, representing 128 observations on boys ranging in age from a few months to 13 years and above, were all obtained with the coöperation of Dr. Fritz B. Talbot of Boston and the detailed results of the investigation will shortly be published in conjunction with him by the Carnegie Institution of Washington.

The total calories per 24 hours referred to weight are indicated for all the subjects in the chart. A general inspection of this chart shows a distinct trend which follows a reasonably regular course. The scatter of the points about this curve is perhaps surprisingly small, especially when we consider the usual scatter with adults. Indeed, until the collection of

more extensive data shows a different picture, it seems possible to use this curve for predicting the probable basal metabolism of boys within this age-period. Although at first sight it would appear as if the grouping of the points around the curve were closer for the boys weighing less than 10 kg. than for those of greater weight, percentagewise, the deviations are greater at the lower weights. The curve has, therefore, been arbitrarily divided for consideration into two sections showing the values obtained with boys below and above 10 kg., respectively.



BASAL HEAT PRODUCTION OF BOYS PER 24 HOURS REFERRED TO BODY WEIGHT

By comparing the actually measured heat output per 24 hours for these boys with the predicted heat output read from this curve for corresponding weights, we find that with 60 subjects below 10 kg., the prediction average is 368 calories against an average of 364 calories from measured values. With 68 subjects above 10 kg., the average predicted value is 911 calories as compared with 907 calories obtained by actual measurement.

These pictures can be looked upon only as a proof of the legitimacy of the curve as sketched. But when individual cases are considered, we find that with boys under 10 kg. there is an average plus or minus deviation of predicted from actual of 30 calories or somewhat over 8%. With the 68 values above 10 kg. the predictions are considerably closer, since the deviations are plus or minus 54 calories on the average, or an average difference of 6.3%. It thus appears that from this curve alone one may

predict the heat output of boys weighing 10 kg. and above to within an average accuracy of a little over 6%.

From data obtained by the Nutrition Laboratory of the basal metabolism of 136 men, Dr. J. Arthur Harris[1] has derived by biometric analysis a multiple prediction formula which may be used for predicting the 24-hour basal heat production of men, as follows:

$$h = + 66.4730 + 13.7516w + 5.0033s - 6.7550a$$

In this formula h = total heat production per 24 hours, w = weight in kilograms, s = stature in centimeters, and a = age in years.

Although in publishing this formula, it was specially emphasized that its application to the lower ages was not yet justified, owing to the fact that of the 136 subjects studied, but few were below 20 years of age, it has been of unusual interest to attempt a prediction of the heat output of these boys, using the multiple prediction formula for men. By this entirely independent method of prediction, we find that the average metabolism of the group of boys above 10 kg. is predicted to within 6 calories, that is, 907 calories actual as against 901 calories predicted. The average deviation for individual predictions is plus or minus 56 calories or 6.3%, giving a prediction with an accuracy identical with that obtained from the curve. This is of considerable practical importance as evidence that the metabolism of males ranging from boys of 10 kg. up to full grown adults, including the period of old age, may be predicted with this formula with an accuracy of not far from plus or minus 6%. For ordinary purposes the pediatrician will prefer to use the values drawn from the curve. To simplify its use, a table giving the most probable heat production of boys per 24 hours predicted directly from body weight has been prepared.

BASAL HEAT PRODUCTION OF BOYS PER 24 HOURS PREDICTED FROM BODY WEIGHT

WEIGHT	CALORIES	WEIGHT	CALORIES	WEIGHT	CALORIES	WEIGHT	CALORIES
kg.		*kg.*		*kg.*		*kg.*	
		11	590	21	885	31	1140
		12	625	22	910	32	1160
3	150	13	660	23	940	33	1180
4	210	14	695	24	965	34	1200
5	270	15	725	25	990	35	1220
6	330	16	755	26	1020	36	1240
7	390	17	780	27	1045	37	1255
8	445	18	805	28	1070	38	1275
9	495	19	830	29	1090		
10	545	20	860	30	1115		

While with adults it was clearly demonstrated that in predicting the heat output consideration should be given not only to body weight but likewise to age and stature, it is evident from this treatment that the pre-

diction from the curve based on body weight alone is of equal value with that from the formula, taking into consideration not only weight but also stature and age. This is probably in large part explained by the fact that with boys the changes in age, weight, and stature are closely correlated.

[1] Harris and Benedict, *Carnegie Inst., Washington, Pub.*, No. 279, 1919; see also these PROCEEDINGS, **4**, 1918 (370–373).

THE NATURE AND FUNCTION OF THE ANTINEURITIC VITAMINE[1]

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Communicated by W. A. Noyes, November 17, 1919

Introductory.—Prior to and immediately following the year 1897 various theories were advanced by different investigators relative to the etiology of the oriental disease known as beri-beri. The merits and demerits of the various theories extant at that period are discussed in a very comprehensive way by W. L. Braddon in his book, "The Cause and Prevention of Beri-Beri." It will suffice to say that the prevailing theories held at that time explained the etiology of the disease in terms of bacteria, bacterial poisons, or poisons contained within the food.

During the years 1889 to 1897 Eijkman and his colleagues had advanced the study of the disease to the point where they were able to demonstrate that beri-beri could be produced at will on a diet consisting solely of polished rice, but that a cure could be effected and a recurrence of the disease prevented by the use of hand-milled rice. Eijkman[2] also showed that a disease similar to human beri-beri could be produced in fowls by diets composed of polished rice and that the paralytic symptoms disappeared upon the administration of rice polishings or alcoholic extracts of rice polishings. Schaumann,[3] in 1910, introduced a phosphorus-deficiency theory, basing his convictions upon the fact that all curative foodstuffs possessed a high percentage of phosphorus, while in the case of the non-curative foods the reverse seemed to be true. Schaumann believed the organic phosphorus-containing compounds to be essential in the treatment of beri-beri. This theory was propounded at a time when a great deal of importance was being attached to the lipoid content of the dietary. Other writers[4,5] have shown that a parallelism exists between the phosphorus content of cereals and their vitamine activity, but this parallelism is considered to be fortuitous rather than an actual chemical relationship.

Views Concerning Its Chemical Characteristics.—In 1911 Funk[6] announced